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LIFE HISTORY AND CONTROL OF THE LODGEPOLE PINE NEEDLEMINER RECURVARIA MILLERI BUSCK IN YOSEMITE NATIONAL PARK

Season of 1938

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Berkeley, California
February 3, 1939

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Season of 1938

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LIFE HISTORY AND CONTROL OF THE LODGEPOLE PINE NEEDLEMINER, RECURVARIA MILLERI BUSCK IN YOSEMITE NATIONAL PARK
Season of 1938

Since this insect has a two year life cycle, nothing can be added to the information reported last year on activities during the flight period; this memorandum, therefore, will serve merely to record the relatively few observations made during the past season - a non-flight year.

LIFE HISTORY STUDIES

The small trees at the field station (Eight-mile) which had been artificially infested in 1937 proved to be unsatisfactory. The infestation was quite irregular and during the past winter (1937-1938) most of the larvae died. The few that survived migrated to new needles early in the spring, whereas this event normally takes place in the fall.

On July 7 and again on August 13 needles were collected from naturally infested trees in Forsyth Basin and placed in rearing cages at the field station. As the larvae left the needles they were transferred to the small trees for further observation. They quickly entered the needles on either new or old growth by boring through the concave surface near the tip; this is a different procedure from that of the newly hatched larvae which practically always enter through the convex surface. These migrating larvae measure about 3 to 4 mm, and there are two distinct color phases, a pale cream and a reddish orange; no significance could be ascribed to this color difference. In many of the larvae of both colors small paired black bodies could be seen in the posterior third of the body. The origin or function of these bodies was not evident; they may have been the developing male gonads. Specimen larvae were collected in alcohol and will be dissected during the winter if time permits.

Migration of the half grown larvae to new needles in the fall, the principal event in the non-flight year, was not observed in the field because of assignment to other duties. It appears, however, that the period of migration varies considerably from one area to another, probably due to difference in temperature. In Forsyth Basin (elevation 9200 feet) a few new mines were found as early as August 11; in upper Matterhorn Canyon (elevation 9500 feet) migration had not started by August 27; and in lower Kerrick Canyon (elevation 8500 feet) over half the larvae had started new mines by September 1.

Of the several hundred mined needles and larvae examined during the past season, there was no indication that any pupation or adult emergence occurred. This, of course, is only a further substantiation of many earlier observations

PARASITES

Determinations have recently been received of the parasites and associated species collected in 1937. The most common were:

	Hopkins U.S. No.
Apanteles californicus Meus.	32255-o
Amblymerus n. sp.	32255-c
Neoderostenus n. sp.	32255-b
Phaeogenes n. sp.	32255-e

Apanteles californicus Meus. was found only in the larval stage of the needleminer. At the time when the host would normally prepare for pupation the parasite larva bores out through the body wall between the fourth and sixth segments. This larva is nearly as long as its host, is orange in color, and has prominent brown to black eye spots. The first day after leaving the host a light cocoon is spun and within a day or two the pupa forms. The new pupa is yellow in color, but soon starts to turn darker from the head back; by the sixth to the eighth day the body has turned completely black and the adult appears fully formed. The adult emerges on the twelfth to the fourteenth day.

Amblymerus n. sp. was secured in numbers and was reared from the larval stage of the needleminer. Pupation takes place within the shriveled body of the host and as many as eleven adults emerged from one needleminer larva. It is quite possibly a secondary parasite.

Neoderostenus n. sp. was represented by only a third as many individuals as the preceding species. It may also prove to be a secondary parasite.

Phaeogenes n. sp. was found to emerge as adults from the pupal stage of the host. The numbers of this species were relatively low.

Several other species of parasitic hymenoptera were collected from the cages containing infested needles. Further studies will be required to determine just which are parasites of the needleminer; to learn just how these parasites adjust themselves to a host having a two year life cycle; and to what extent they are responsible for the reduction of needleminer populations.

OTHER NEEDLEMINER SPECIES

Other needleminer species were investigated only as an incidental endeavor. Those which had previously been reported on western white pine and Jeffrey pine were observed, but were not present in sufficient numbers to cause injury. It was not possible to rear any adults from these specimens.

Further collections were made of the needleminer (Recurvaria sp. near milleri) on white fir. Apparently this species has a one year life cycle. It is widely distributed on the white fir in the park but has not been observed to cause any appreciable defoliation.

During examination of the lodgepole pines at Pot Hole Meadow, an area from which needleminer has never been reported, three mined needles and a pupa were found. It was feared that a population of R. milleri might be developing in this area, but the adult which issued from the pupa was distinctly not the one commonly found; the markings were different; it was larger in size; and emerged in the non-flight year of R. milleri. It seems then that lodgepole pine is host to at least two species of needleminer. Whether this new species ever develops into serious numbers is not known, for only the one specimen has been found.

CONTROL STUDIES

Observations were continued on the various control tests applied in 1937.

Of the 22 uninfested trees at Pot Hole Meadow treated to test foliage tolerance, only the one sprayed with formula 22 (vapodust plus dinitro - 1%)* still showed some spot burning, but was recovering.

No further information could be secured from the small trees at Eight-mile as most of the larvae in both the treated and the check trees died during the winter. The trees which had been treated with dinitro still showed the effect of burning, but these also were recovering; all other treated trees were in excellent condition.

As was the case at Eight-mile, nearly all the larvae in the sprayed and unsprayed trees at Porcupine Flat died during the winter, so no valid comparison of different formulae can be made. The only trees which still show foliage injury are, again, those treated with dinitro, and they will recover.

Three examinations were made of the naturally infested sprayed trees in Forsyth Basin. Samples of foliage were collected from the upper third of both treated and untreated trees for comparative counts of mined needles and larvae, details of which are given in the table at the end of the memorandum. A few formulae show sufficient promise to warrant field testing with a power spray rig, if an infestation should develop in an accessible area. The following have given the best control so far:

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* As used in this report, dinitro is dinitro-ortho-cyclo-hexyl-phenol.

Tree Number	Formula*	
13 & 14	Lead arsenate	4 lbs.
	Nicotine sulphate 40%	1 pint
	"Dynamite spreader	½ lb.
	Kerosene	2 quarts
18 & 19	Light medium oil	4%
	Nicotine sulphate 40%	1 pint
	Blood albumin	4 oz.
5 & 6	Light medium greenol (oil)	4%
	Conditioner (oleate)	2 lbs.
	Orthonicotine	5 lbs.
16 & 17	Lead arsenate	4 lbs.
	Light medium oil	4%
	Nicotine sulphate 40%	1 pint
	Blood albumin	4 oz.

Some of the vaporized oil combinations produced high mortality in the tests, but coverage was frequently so irregular because of air movement, that this type of insecticide cannot be considered practical for these areas in which there is nearly always at least a light breeze blowing.

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* All ingredients are given on the basis of 100 gallons of mixture unless otherwise stated.

FORMULAE TESTED

No.	Formula	
1	Lead arsenate	4 lbs.
	Nicotine sulphate 40%	1 pint
	"Dynamite" spreader	½ lb.
	Kerosene	2 quarts
2	Light medium oil	4 %
	Nicotine sulphate 40%	1 pint
	Blood albumin	4 oz.
3	Dinitro	0.03%
	Light medium oil	3.0%
	Blood albumin	4 Oz.
4	Vapo dust heavy	99%
	Nicotine 95% (atomized)	1%
5	Vapo dust A (light)	99%
	Nicotine 95% (atomized)	1%
6	Light medium greenol	4%
	Conditioner (oleate)	2 lbs.
	Orthonicotine	5 lbs.
7	Lead arsenate	75 lbs.
	Nicotine 95%	1%
	Water to make volume (atomized)	
8	Lead arsenate	4 lbs.
	Light medium oil	4%
	Nicotine sulphate 40%	1 pint
	Blood albumin	4 Oz.
9	Vapo dust C (medium)	99%
	Nicotine 95% (atomized)	1%
10	Phenothiazine	3 lbs.
11	Lethane 440	1:400
	Light medium oil	4%
	Blood albumin	4 oz.
12	Vapo dust B (heavy)	99%
	Nicotine 95% (atomized)	1%
13	Dinitro	1%
	Vapo dust (heavy)	50%
	Water to make volume (atomized)	
14	Japanese beetle repellant	4 lbs.
15	Dinitro	0.61%
	Light medium oil	1.0%
	Blood albumin	4. oz.

1937 FORSYTH SPRAY TESTS - SAMPLED AUG. 11,1938

1937 FORSYTH SPRAY TESTS - SAMPLED AUG. 11, 1938

Form. No.	Tree No.	New Growth Sound Needles	New Growth Mined Needles	New Growth Larvae	1 Year Needles Sound Needles	1 Year Needles Mined Needles	1 Year Needles Larvae	Over 1 Year Needles Sound Needles	Over 1 Year Needles Mined Needles	Over 1 Year Needles Larvae	Totals Sound Needles	Totals Mined Needles no.	Totals Mined Needles no/M*	Larvae no.	Larvae no/M	Comments
1	13 14	748	0	0	669	0	0	1199	13	0	2616	13	5.0	0	0.0	Deposit quite noticeable
2	18 19	2256	0	0	2845	3	0	2259	48	1	7411	51	6.9	1	0.1	
3	3 4	1044	0	0	822	4	1	851	13	1	2717	17	6.2	1	0.4	Objection-able foliage injury
4	24 25	2592	0	0	3301	25	3	2939	51	1	8832	76	8.5	4	0.5	Irregular coverage
5	26 27	1984	0	0	2681	5	3	2172	75	1	6837	80	11.6	4	0.6	Irregular coverage
6	5 6	1834	0	0	1484	8	7	1624	32	4	4982	40	8.0	4	0.8	
7	22 23	2516	13	13	2100	4	0	3591	18	0	8207	35	4.3	13	1.6	Irregular coverage
8	16 17	2024	2	2	1817	6	2	3139	60	9	6980	68	9.7	13	1.8	
9	30 35	1491	3	3	1366	24	4	208	76	4	4865	103	21.4	11	2.3	Irregular coverage
10	7 8	2818	3	1	3214	71	13	2494	233	6	8526	307	34.8	26	2.3	
11	9 10	1947	0	0	1568	5	4	2757	58	24	6292	63	9.9	28	4.4	

1937 FORSYTH SPRAY TESTS - SAMPLED AUG. 11.1938 (cont.)

Form. No.	Tree No.	New Growth Sound Needles	New Growth Mined Needles	New Growth Larvae	1 Year Needles Sound Needles	1 Year Needles Mined Needles	1 Year Needles Larvae	Over 1 Year Needles Sound Needles	Over 1 Year Needles Mined Needles	Over 1 Year Needles Larvae	Totals Sound Needles	Totals Mined Needles no.	Totals Mined Needles no/M*	Larvae no.	Larvae no/M	Comments
12	28 29	2099	13	13	2287	43	14	1606	13	7	5992	90	14.8	34	5.6	Irregular coverage
Check	31	1912	2	2	679	30	8	1045	48	12	3636	80	21.5	24	6.5	
Check	32	1536	2	2	1406	42	21	1795	193	14	4737	237	47.7	37	7.4	
13	20 21	1692	5	5	1372	91	11	1160	170	24	4224	271	60.6	40	8.9	
14	11 12	1961	5	5	2186	**	25	2334	***	48	6481	***	****	78	12.0	
Check	33	364	0	0	1137	9	3	1279	101	40	2780	109	37.7	43	14.8	
Total Checks	15,31 32,33 34	5501	13	13	5029	456	154	5144	672	191	15674	751	45.8	268	16.3	
15	1 2	1141	3	3	1599	43	23	1392	124	81	4132	178 ~~186~~	39.6	107	24.1	Light burning
Check	15	1260	8	8	1347	101	71	800	114	74	3407	222	57.2	153	39.5	
Check	34	429	1	1	460	274	51	225	216	51	1114	464	301.2	103	65.4	

* Number of mined needles per thousand needles examined